

ET1624 - Matrix LED Controller and Driver

General Description

ET1624 is an LED Controller driver with 11 segment output lines, 4 grid output lines, 3 segment/grid output lines, one display memory, control circuit are all incorporated into a single chip to build a highly reliable peripheral device for a single chip microcomputer. Serial data is fed to ET1624 via a three-line serial interface, ET1624 pin assignments and application circuit are optimized for easy PCB Layout and cost saving advantages.

Features

- CMOS Technology
- Low Power Consumption
- Multiple Display Modes(14Segs × 4Grids ~11Segs × 7Grids)
- 8-step Dimming Circuitry
- 3-Serial Interface for Clock, Data Input/Output, Strobe Pins
- Built in RC oscillation
- Package: SOP24(ET1624M)

Device Information

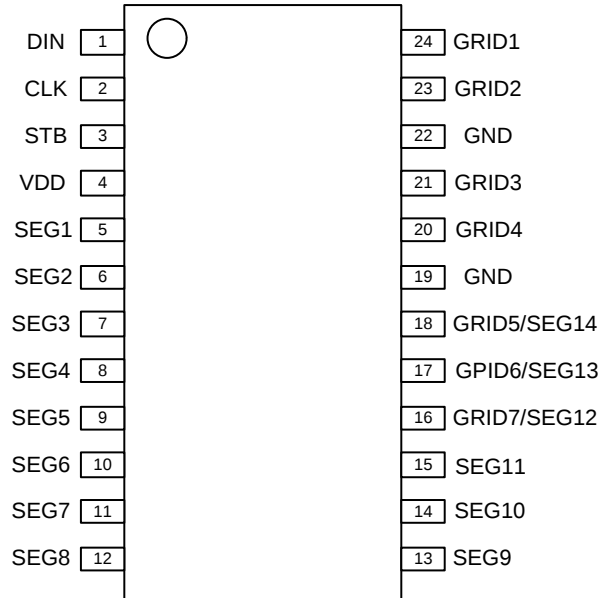
Part No.	Package	Size
ET1624M	SOP24	15.34mm × 10.20mm

Application

- Household appliances, Toy display
- Smart portable devices, Smart audio

ET1624

Pin Assignments



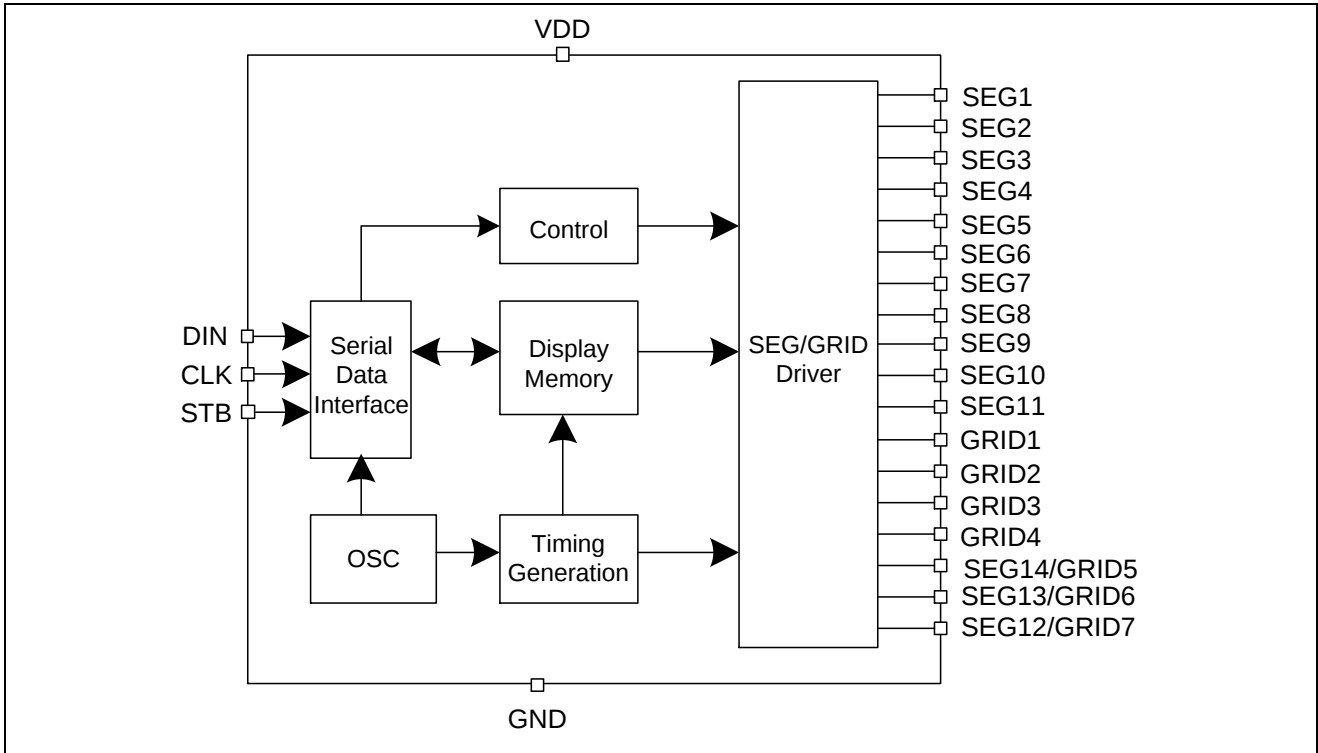
Top View

Pin. Function

Pin No.	Pin Name	I/O	Description
1	DIN	I	Data Input Pin
2	CLK	I	Clock Input Pin
3	STB	I	Serial Interface Strobe Pin
4	VDD	—	Power Supply
5~15	SEG1~SEG11	O	Segment output, connected to LED anode.
16 ~ 18	GRID7/SEG12 ~ GRID5/SEG14	O	Segment/Grid Output Pins
19, 22	GND	—	GNDs
20, 21, 23, 24	GRID4~GRID1	O	Grid output, connected to LED cathode.

ET1624

Block Diagram



Functions Description

Command

After the STB port status changes from high to low, input command bytes through the DIN port. If the STB port is set to high for some reason while the data or command is being transmitted, the serial communication is initialized and the data/command being entered is considered invalid.

Command 1: display mode setting command

The display mode setting command determines the number of segments (4~7 grids, 11~14 segments) used. A display command must be executed to continue the display. If the same mode is selected, the command is not executed.

MSB						LSB		Function	Description
B7	B6	B5	B4	B3	B2	B1	B1		
0	0	NC, Set to 0 please				0	0	Display segment and grid setting	14 Segs×4 Grids
0	0					0	1		13 Segs×5 Grids
0	0					1	0		12 Segs×6 Grids
0	0					1	1		11 Segs×7 Grids

ET1624

Command2: Data Command Setting

Data setup commands perform write display data .When the power supply is powered on, bits 4 to 1 (B3 to B0) should be set to 0.

MSB

LSB

B7	B6	B5	B4	B3	B2	B1	B0	Function	Description
0	1	NC, Set to 0 please		0				Mode setting	Normal mode
				1					Test mode
					0			Address mode	Automatic address increase
					1				Fixed address
						0	0	Write Data	Display data input mode

Command3: Display Address Setting

The address setting command is used to set the display memory address.If the address ranges from 00H to 0DH, the address is valid.If the address is 0EH or higher, the data is invalid unless the correct address is set again.When the power supply is powered on, the address is 00H.

MSB

LSB

B7	B6	B5	B4	B3	B2	B1	B0	Description
1	1	NC, fill in 0		0	0	0	0	Display address 00H
1	1			0	0	0	1	Display address 01H
1	1			0	0	1	0	Display address 02H
1	1			0	0	1	1	Display address 03H
1	1			0	1	0	0	Display address 04H
1	1			0	1	0	1	Display address 05H
1	1			0	1	1	0	Display address 06H
1	1			0	1	1	1	Display address 07H
1	1			1	0	0	0	Display address 08H
1	1			1	0	0	1	Display address 09H
1	1			1	0	1	0	Display address 0AH
1	1			1	0	1	1	Display address 0BH
1	1			1	1	0	0	Display address 0CH
1	1			1	1	0	1	Display address 0DH

Address assignment:

SG1.....SG4	SG5.....SG8	SG9.....SG12	SG13.....SG14	Matrix Address
00H _L	00H _U	01H _L	01H _U	GRID1
02H _L	02H _U	03H _L	03H _U	GRID2
04H _L	04H _U	05H _L	05H _U	GRID3
06H _L	06H _U	07H _L	07H _U	GRID4
08H _L	08H _U	09H _L	09H _U	GRID5
0AH _L	0AH _U	0BH _L	0BH _U	GRID6
0CH _L	0CH _U	0DH _L	0DH _U	GRID7

ET1624

Definition of H_U and H_L in RAM address:

B0	B1	B2	B3	B4	B5	B6	B7
xxH _L				xxH _U			
Low 4bits				High 4bits			

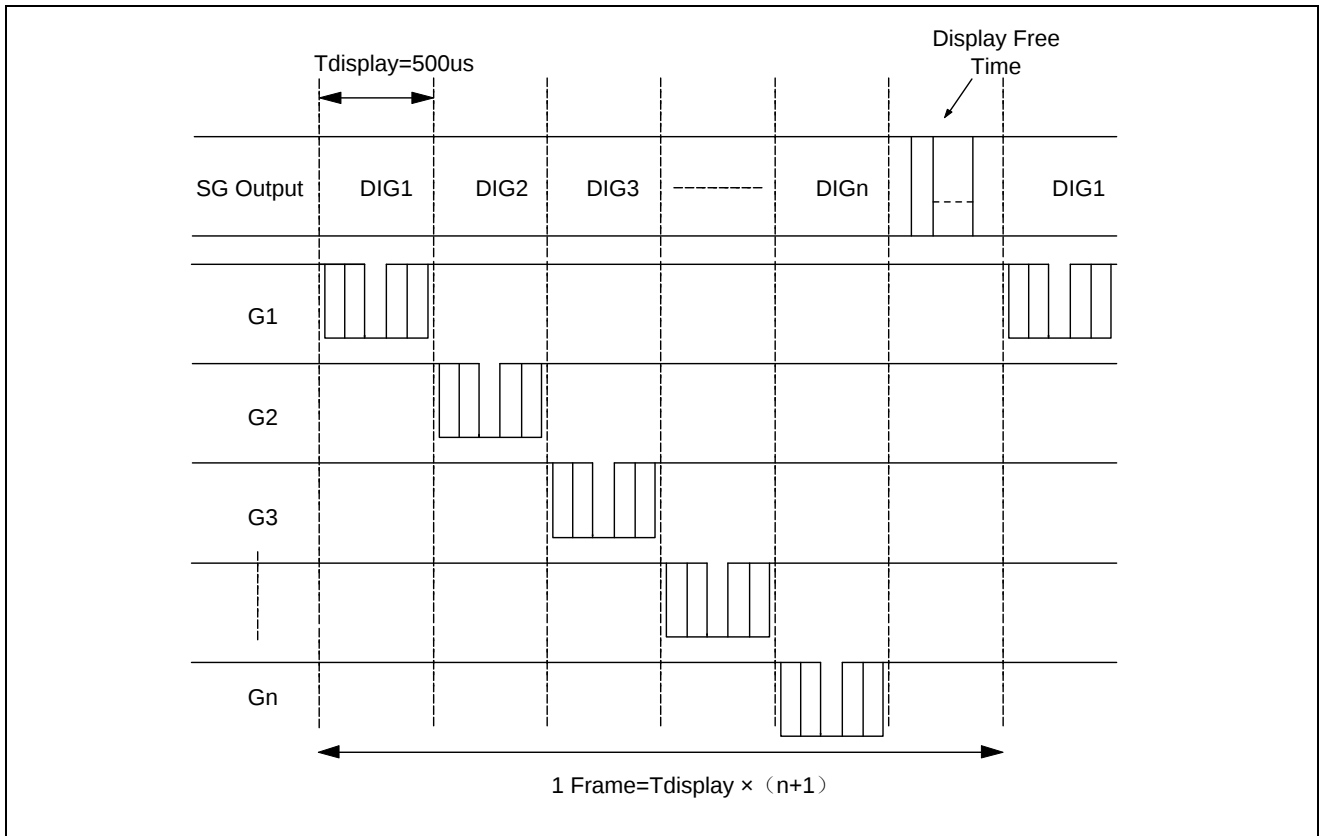
Command4: Display Control Setting

MSB

LSB

B7	B6	B5	B4	B3	B2	B1	B0	Function	Description
1	0	NC, fill in 0			0	0	0	Display duty cycle setting	Duty cycle is 1/16
1	0				0	0	1		Duty cycle is 2/16
1	0				0	1	0		Duty cycle is 4/16
1	0				0	1	1		Duty cycle is 10/16
1	0				1	0	0		Duty cycle is 11/16
1	0				1	0	1		Duty cycle is 12/16
1	0				1	1	0		Duty cycle is 13/16
1	0				1	1	1		Duty cycle is 14/16
1	0			0				Display ON / OFF setting	Display OFF
1	0			1					Display ON

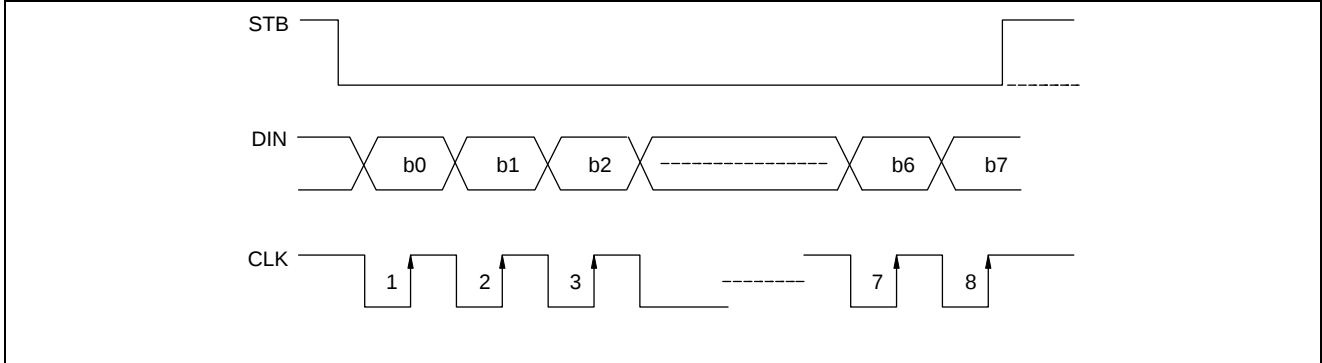
Display Sequence Timing



ET1624

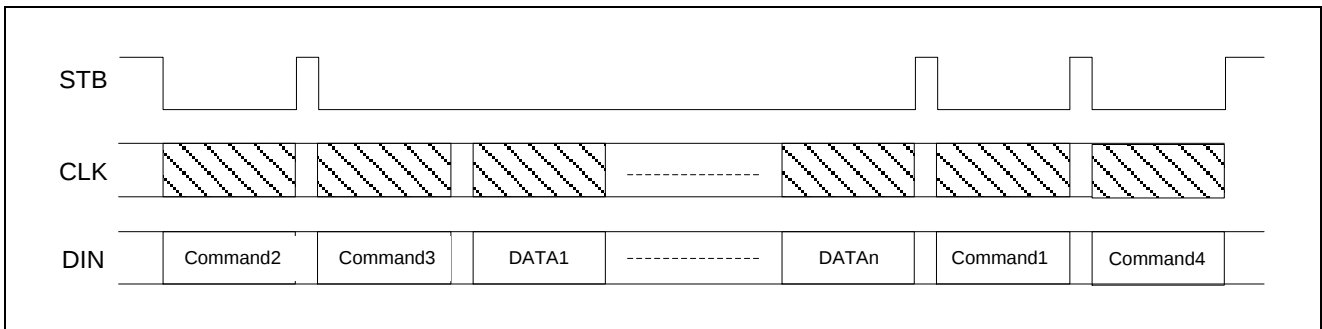
Serial Communication Format

The following figure shows the serial communication format of ET1624. It is recommended to connect a pull-up resistor (1K ~ 10K) to the DIN port.



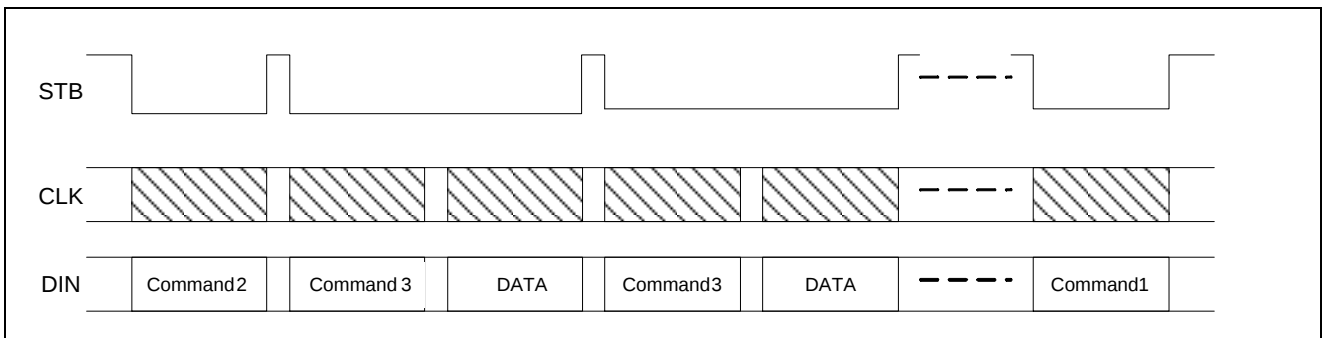
Communication application time series

Continuous display data writing (Automatic address increase)



- Command1: Display mode setting
- Command2: Data command setting
- Command3: Address command setting
- DATA1~_n: Display data (MAX 14 bytes)
- Command4: Display control command

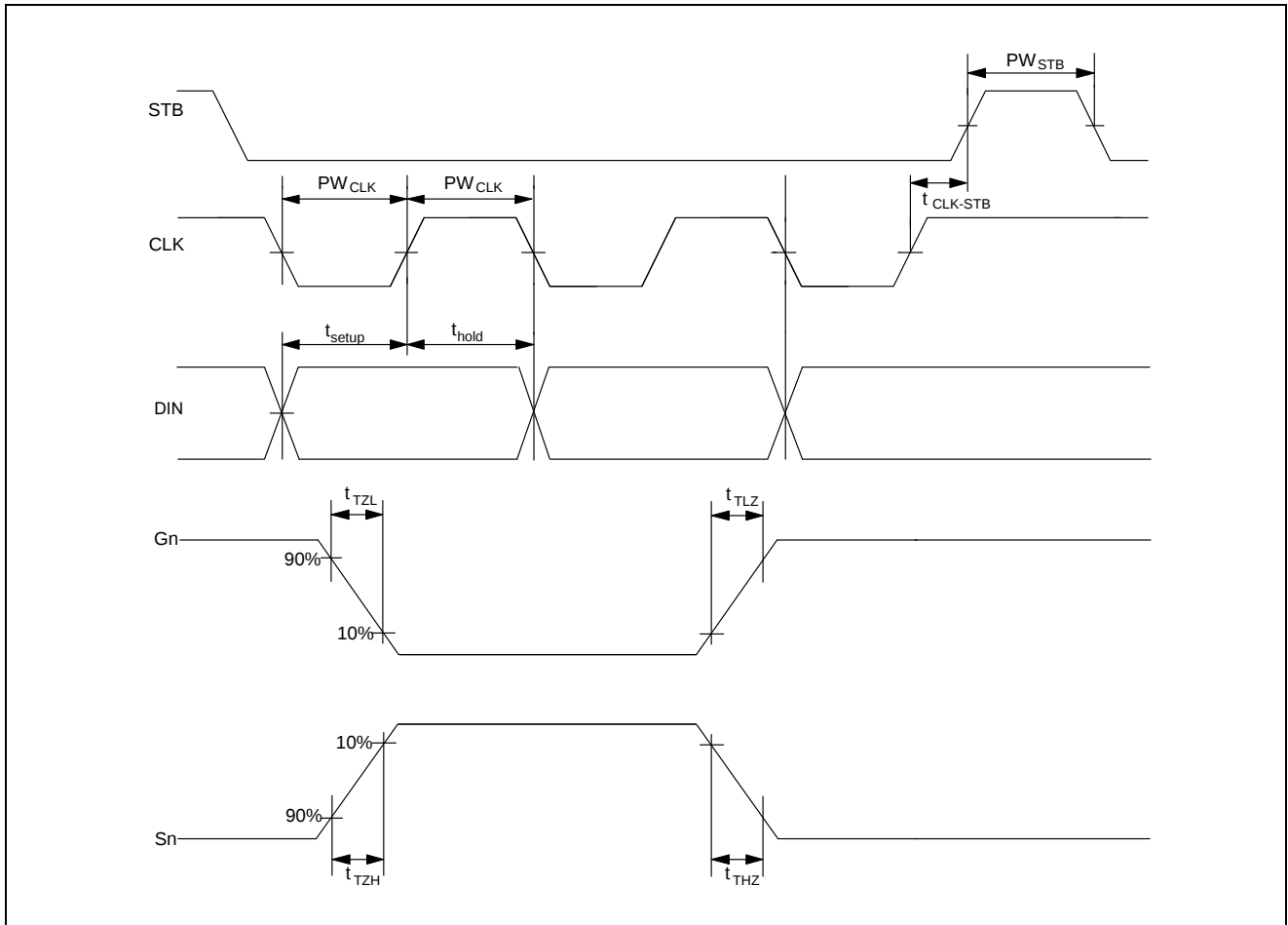
Single display data writing (fixed address mode)



- Command1: Display mode setting
- Command2: Data command setting
- Command3: Address command setting
- DATA: Display data

ET1624

Conversion Characteristic Waveform

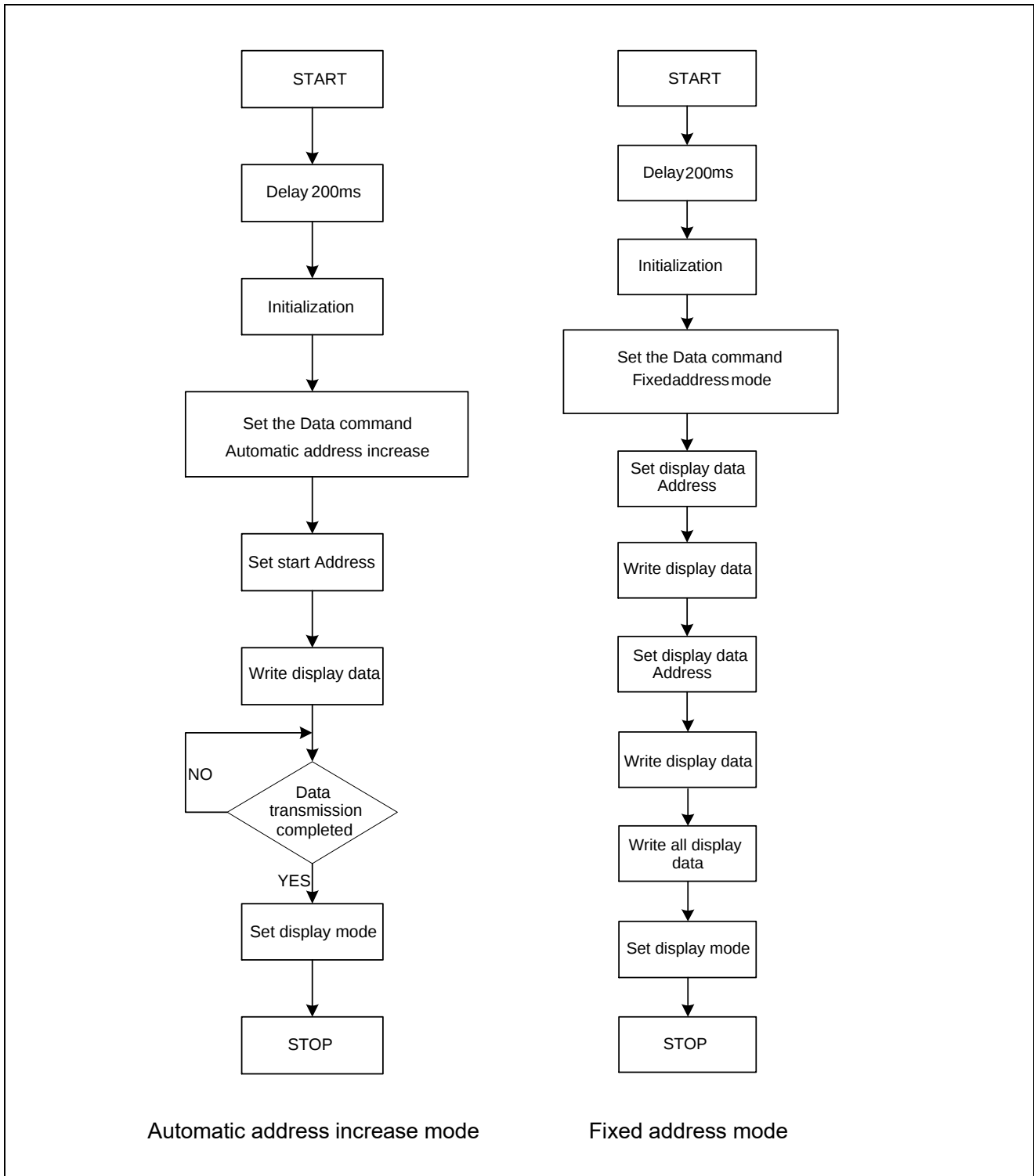


Transformation Characteristic

Symbol	Descripton	Range	Units
PW_{CLK}	CLK pulse width	≥ 400	ns
PW_{STB}	STB pulse width	≥ 1	us
t_{setup}	Data setup time	≥ 100	ns
t_{hold}	Date hold time	≥ 100	ns
$t_{CLK-STB}$	CLK-STB time	≥ 1	us
t_{THZ}	Falling time	≤ 10	us
t_{TZH}	Rising time	≤ 1	us
t_{TZL}		< 1	us
t_{TLZ}		< 10	us

Note: The test conditions : t_{THZ} (pull-down resistance = 10k Ω , loading capacitance =300pF), t_{TLZ} (pull-up resistance = 10k Ω , loading capacitance =300pF)

Software flow chart



Note: When the IC is powered on for the first time, the contents of the display RAM are not defined, so be sure to clear the contents of the display RAM in the initialization setting.

ET1624

Absolute Maximum Ratings

(Unless otherwise noted , $T_A=25^{\circ}\text{C}$)

Characteristic	Symbol	Rating	Unit
Supply Voltage	V_{DD}	-0.5~+7.0	V
Logic Input Voltage	V_I	-0.5~ $V_{DD}+0.5$	V
Driver Output Current	I_{OLGR}	+250	mA
	I_{OHSG}	-50	mA
Max Output Driver current	I_{TOTAL}	250	mA
Junction Temperature	T_J	-40~+150	$^{\circ}\text{C}$
Storage Temperature	T_{STG}	-55~+150	$^{\circ}\text{C}$

Recommended Operating Conditions

(Unless otherwise noted , $T_A=25^{\circ}\text{C}$)

Characteristic	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{DD}	3.0	5.0	5.5	V
Dynamic current	$I_{DD_DYN}^*$	—	—	1	mA
High Level Input Voltage	V_{IH}	$0.8V_{DD}$	—	V_{DD}	V
Low Level Input Voltage	V_{IL}	0	—	$0.25V_{DD}$	V
Operating Temperature	T_A	-40		85	$^{\circ}\text{C}$

Note*: Test condition Set display mode command = 80H (display off & no load).

ET1624

Electrical Characteristics

(Unless otherwise noted, $V_{DD}=5V$, $T_A=25^\circ C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
High Level Output Current	I_{OHSG1}	$V_O=V_{DD}-2V$, SEG1~SEG11, SEG12/GRID7~SG14/GRID5	-40	-50	-60	mA
	I_{OHSG2}	$V_O=V_{DD}-3V$, SEG1~SEG11, SEG12/GRID7~SEG14/GRID5	-50	-60	-70	mA
Low Level Output Current	I_{OLGR}	$V_O=0.3V$, GRID1~GRID4, SEG12/GRID7 SEG14/GRID5	85	100	—	mA
Percentage of high level output current at segment	I_{TOLSG}	$V_O=V_{DD}-3V$, SEG1~SEG11, SEG12/GRID7~SEG14/GRID5	—	—	+5	%
High Level Input Voltage	V_{IH}	—	$0.6V_{DD}$	—	V_{DD}	V
Low Level Input Voltage	V_{IL}	—	0	—	$0.3V_{DD}$	V
Oscillation Frequency	F_{OSC}		350	500	650	kHz

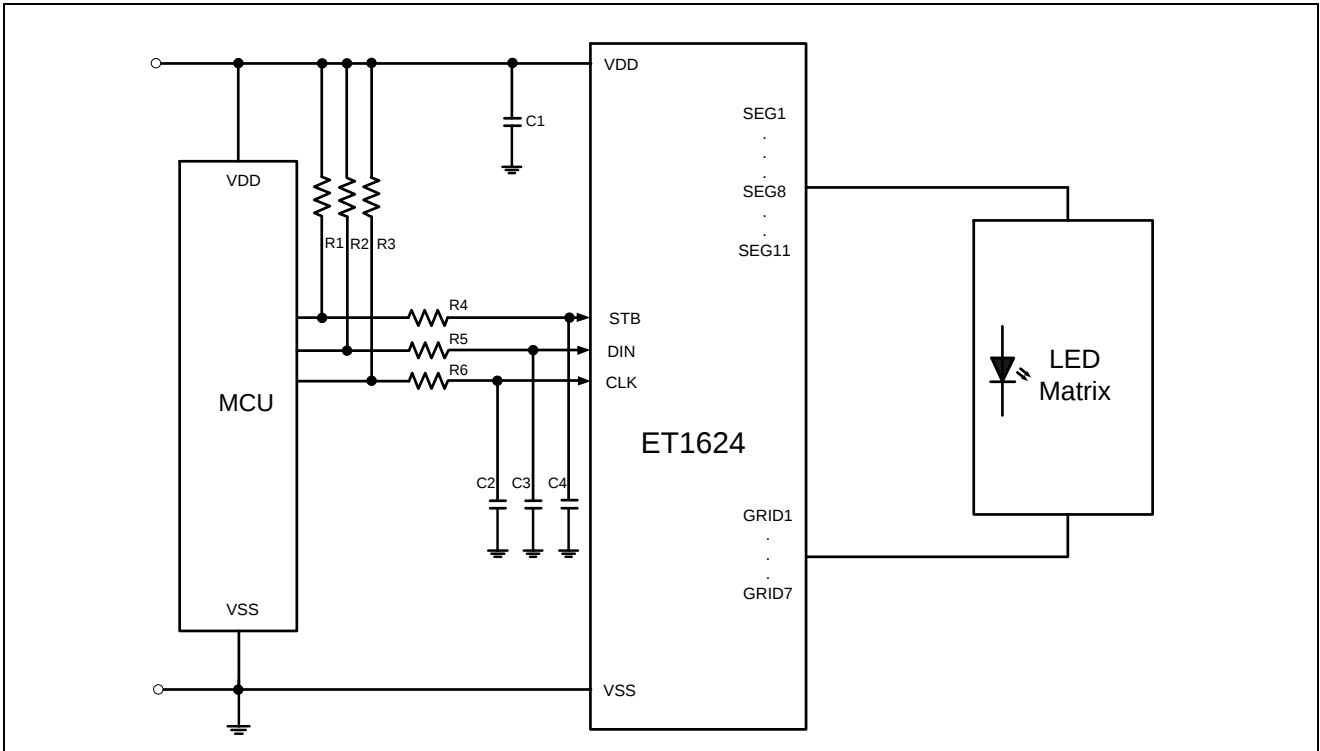
Electrical Characteristics

(Unless otherwise noted, $V_{DD}=3.0V$, $T_A=25^\circ C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
High Level Output Current	I_{OHSG1}	$V_O = V_{DD} - 2V$, SEG1~SEG11, SEG12~SEG14	-15	-20	-35	mA
Low Level Output Current	I_{OLGR}	$V_O=0.3V$, GRID1~GRID7,	100	140	—	mA
High Level Input Voltage	V_{IH}	—	$0.8V_{DD}$	—	3.3	V
Low Level Input Voltage	V_{IL}	—	0	—	$0.25V_{DD}$	V
Oscillation Frequency	F_{OSC}		300	420	580	kHz

ET1624

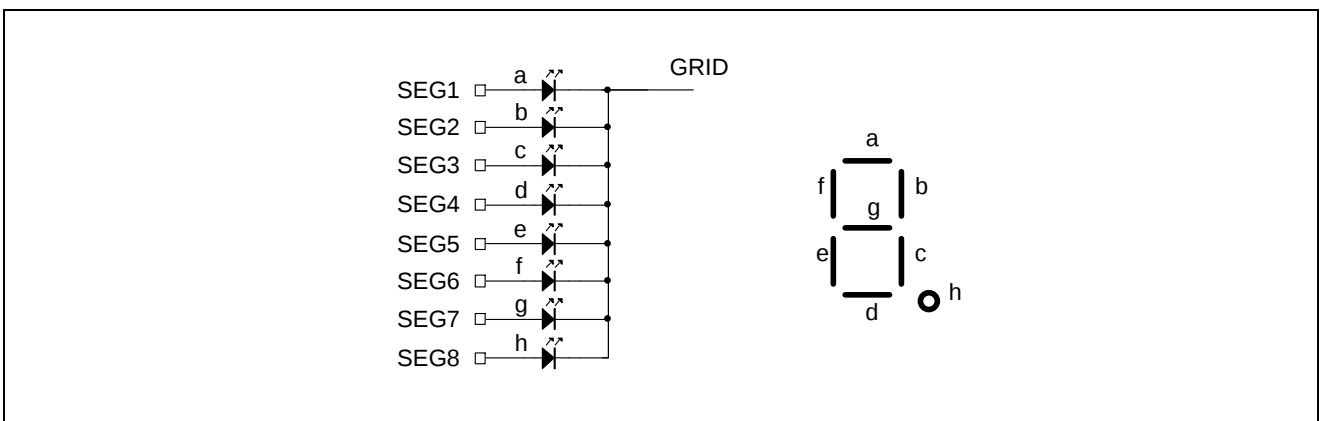
Application circuit



Notes:

1. This application circuit is only for reference.
2. C1=1uF and should be placed as close as possible to the VDD.
3. The series resistance of the communication port and the capacitor for GND should be placed as close as possible to ET1624, and the resistance value and capacitance value should be adjusted according to the actual anti-interference requirements and verification results.

Common cathode LED connection

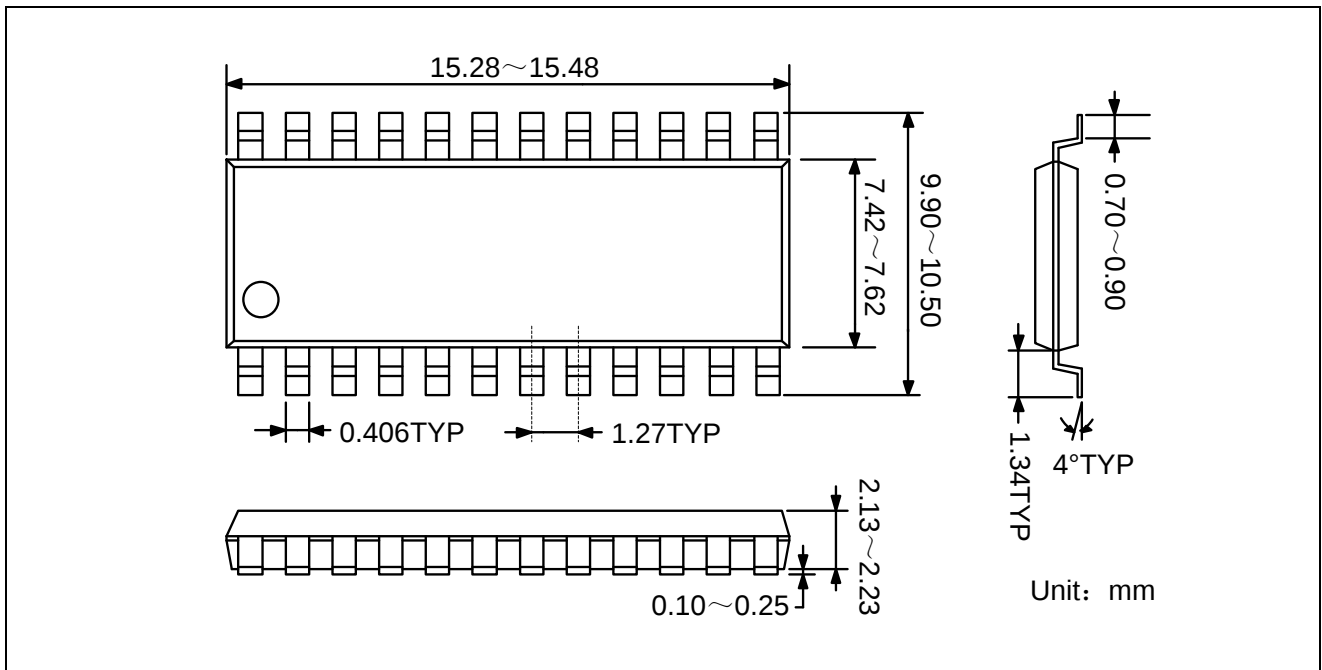


Note: This application circuit is only for reference.

ET1624

Package

SOP24



Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2018-01-19	Original Version	Shi Liang Jun	Shi Liang Jun	Zhu Jun Li
1.1	2020-04-07	Update form	Shi Bo	Shi Liang Jun	Shi Bo
1.2	2022-12-20	Update form	Lv Yue Jin	Shi Bo	Shi Bo